10087781 . 06PCT/AU00/01196
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CLAIMS

1. A progressive ophthalmic lens element including a lens surface having

an upper viewing zone having a surface power corresponding to distance vision,

a lower viewing zone having a greater surface power than the upper viewing zone to achieve a refracting power corresponding to near vision; and

an intermediate zone extending across the lens element having a surface power varying from that of the upper viewing zone to that of the lower viewing zone and including a corridor of relatively low surface astigmatism;

the lens surface including

a relatively high, relatively wide lower viewing zone; and

a relatively wide intermediate zone wherein the upper viewing zone and lower viewing zone are such that the ratio of the area of clear vision of the upper viewing zone to the lower viewing zone is less than approximately 3.00 and greater than approximately 2.50.

2. A progressive ophthalmic lens according to claim 1 wherein the area of the lower viewing zone inside a 22 mm radius circle centred on the geometric centre and constrained by the Add/4 diopters RMS power error contour for a 0.4 m reading distance, is greater than approximately 150 mm^2, and

the height of the lower viewing zone defined by the Add/4 diopters RMS power error contour is in the range of approximately 10 to 12 mm below the fitting cross.

3. A progressive ophthalmic lens element according to Claim 1, further including a surface correction(s) in the peripheral regions of the lens element which functions to reduce or minimise optical aberrations contributing to the phenomenon of swim.

4. A progressive ophthalmic lens element according to Claim 3, wherein the surface correction(s) function to reduce optical aberrations in lens surface areas including a pair of generally horizontally disposed opposed sectors

10087781 . 0 PCT/AU00/01196
Received 16 July 2001
ART 34 AMDT

approximately ±22.5° above and below a generally horizontal axis passing through the fitting cross of the lens element.

5. A progressive ophthalmic lens element according to Claim 4, wherein the opposed sectors have a radius of approximately 15 mm from the fitting cross.

6. A progressive ophthalmic lens element according to Claim 4, wherein the opposed sectors have a radius of approximately 20 mm from the fitting cross.

7. A progressive ophthalmic lens element according to Claim 3, wherein the surface correction(s) provides a reduction in variation of the sagittal addition power within the opposed sectors.

8. A progressive ophthalmic lens element according to Claim 7, wherein the surface correction(s) is such that the difference between maximum and minimum sagittal addition power is less than approximately 0.75* Add diopters.

9. A progressive ophthalmic lens element according to Claim 1, wherein the lens design exhibits a small amount of addition power proximate the fitting cross, depending on the nominal addition power of the lens element.

10. A progressive ophthalmic lens element according to Claim 9, wherein the lens design exhibits approximately 0.05 D to 0.4 D of addition power proximate the fitting cross, depending on the nominal addition power of the lens element.

11. A progressive ophthalmic lens element according to Claim 1, further including a surface correction to improve optical properties proximate the peripheries of the lens element.

12. A progressive ophthalmic lens element according to Claim 11, wherein the distribution of RMS power error is varied proximate the peripheries of the upper and/or lower viewing zones to improve peripheral vision.

13. A progressive ophthalmic lens element series according to Claim 12, wherein the distribution of RMS power error exhibits a relatively low gradient

10087781 . 061202 PCT/AU00/01196
Received 16 July 2001

proximate the distance periphery and a relatively high gradient proximate the near periphery.

14. A progressive ophthalmic lens element according to Claim 13, wherein the ratio of the maximum rate of change of the ray traced RMS power error along the 12 mm long vertical lines centred on the fitting cross (FC) and horizontally offset 15 mm from the FC to the maximum horizontal rate of change of the RMS power error at the level of the near vision measurement point (NMP) varies from approximately 0.4 to approximately 0.6.

15. A series of progressive ophthalmic lens elements, each lens element including a lens surface having

an upper viewing zone having a surface power to achieve a refracting power corresponding to distance vision;

a lower viewing zone having a greater surface power than the upper viewing zone to achieve a refracting power corresponding to near vision; and

an intermediate zone extending across the lens element having a surface power varying from that of the upper viewing zone to that of the lower viewing zone and including a corridor of relatively low surface astigmatism;

the progressive ophthalmic lens series including

lens elements having a base curve suitable for use in providing a range of distance prescriptions for one or more of emmetropes, hyperopes and myopes, each lens element differing in prescribed addition power and including a progressive design including

a relatively high, relatively wide lower viewing zone and

a relatively wide intermediate zone; the dimensions of the intermediate and lower viewing zones being related to the prescribed addition power of the wearer.

16. A progressive ophthalmic lens element series according to Claim 15, wherein each lens element in the series has a progressive lens design exhibiting a small amount of addition power proximate the fitting cross, dependent on the prescribed addition power and the base curve.

17. A progressive ophthalmic lens series according to Claim 16, wherein

10088781 .. 0 PCT/AU00/01196
Received 16 July 2001

the addition power proximate the fitting cross of a progressive lens element is in the range from 0.05 to 0.40 D, the fitting cross addition power increasing with the addition power for each of the base curves, and with the increasing base curve for each addition power.

18. A progressive ophthalmic lens element series according to Claim 16, wherein the lens element series exhibits a slight decrease in the area of the zone clear for distance vision on the lens surface inside a 22 mm radius circle centred on the GC and constrained by the Add/4 diopters RMS power error contour ray traced in the as worn configuration for an infinite object distance with increasing base curve.

19. A progressive ophthalmic lens element series according to Claim 18, wherein the lens elements exhibit an increase in corridor length within increasing addition power.

20. A progressive ophthalmic lens element series according to Claim 19, wherein for low to medium addition powers the lens elements exhibit an increase in effective corridor length from approximately 10 to 12 mm; and for higher addition powers exhibit an effective corridor length of approximately 12 mm.

21. A progressive ophthalmic lens element series according to Claim 15, wherein the progressive lens design of each lens element in the series includes a surface correction(s) in the peripheral regions of the lens element to reduce or minimise the phenomenon of swim.

22. A progressive ophthalmic lens element series according to Claim 21, wherein the surface correction(s) function to reduce optical aberrations in lens surface areas including a pair of generally horizontally disposed opposed sectors approximately ±22.5° above and below a generally horizontal axis passing through the fitting cross.

23. A progressive ophthalmic lens element series according to Claim 22, wherein the opposed sectors have a radius of approximately 15 mm or more.

10087781 . PCT/AU00/01196
Received 16 July 2001

24. A progressive ophthalmic lens element series according to Claim 23, wherein the surface correction takes the form of a reduction in the sagittal addition power variations within each of the opposed sectors.

25. A progressive ophthalmic lens element series according to Claim 24, wherein the difference between maximum and minimum sagittal addition power within each of the opposed sectors is less than approximately 0.75*Add diopters.

26. A progressive ophthalmic lens element series according to Claim 15, wherein each element within the series exhibits a substantially constant area of clear vision on the lens surface within the lower viewing zone.

27. A progressive ophthalmic lens element series according to Claim 15, wherein each lens element includes a surface correction to improve optical properties proximate the peripheries of the lens element.

28. A progressive ophthalmic lens element series according to Claim 27, wherein the distribution of RMS power error is varied proximate the peripheries of the upper and/or lower viewing zones to improve peripheral vision.

29. A progressive ophthalmic lens element series according to Claim 28, wherein the distribution of RMS power error exhibits a relatively low gradient proximate the distance periphery and a relatively high gradient proximate the near periphery.

30. A progressive ophthalmic lens element series according to Claim 29, wherein the base elements have the ratio of the maximum rate of change of the ray traced RMS power error along the 12 mm long vertical lines centred on the fitting cross (FC) and horizontally offset 15 mm from the FC to the maximum horizontal rate of change of the RMS power error at the level of the near vision measurement point (NMP) varies from approximately 0.4 to approximately 0.6.

31. A method of designing an ophthalmic lens element including a first lens surface having

10087781.062002 PCT/AU00/01196
Received 16 July 2001

an upper viewing zone having a surface power corresponding to distance vision,

a lower viewing zone having a greater surface power than the upper viewing zone to achieve a refracting power corresponding to near vision; and

an intermediate zone extending across the lens element having a surface power varying from that of the upper viewing zone to that of the lower viewing zone and including

a corridor of relatively low surface astigmatism; the ophthalmic lens element including

a relatively high, relatively wide lower viewing zone; and

a relatively wide intermediate zone,

which method includes

selecting a merit function relating to at least one optical characteristic of the lens to be minimised with an appropriate distribution of the optimisation weights on the lens surface; and

solving the global minimisation problem using the Finite Element Method; and

fabricating an ophthalmic lens element having a lens surface shaped according to said optimised surface description.